

77.15: 5-81

DIMENSIONAL CHANGES IN PEANUT PODS, KERNELS, AND HULLS AS MOISTURE IS REMOVED DURING DRYING

ARS-S-81

January 1976

CONTENTS

	Page
Abstract	1
Introduction	1
Methods and materials	1
Test results	2
Spanish peanuts	2
Runner peanuts	5
Virginia peanuts	5
Discussion	7
Acknowledgments	8

Illustration

Fig.	
1. Orientation of peanut pods and kernels for measurement	3

Tables

1. Group sizes of peanuts used for pod and kernel measurements	2
2. Three dimensions of Spanish peanut pods measured as moisture content decreased	4
3. Three dimensions of Spanish peanut kernels measured as moisture content decreased	4
4. Dimensions of Spanish peanut hulls at various moisture contents ..	5
5. Three dimensions of runner peanut pods measured as moisture content decreased	4
6. Three dimensions of runner peanut kernels measured as moisture content decreased	6
7. Dimensions of runner peanut hulls at various moisture contents ..	5
8. Three dimensions of Virginia peanut pods measured as moisture content decreased	6
9. Three dimensions of Virginia peanut kernels measured as moisture content decreased	6
10. Dimensions of Virginia peanut hulls at various moisture contents ..	7

DIMENSIONAL CHANGES IN PEANUT PODS, KERNELS, AND HULLS AS MOISTURE IS REMOVED DURING DRYING

By Whit O. Slay¹

ABSTRACT

Virginia, runner, and Spanish peanuts at moisture contents of 35% and above were artificially dried to a 6% moisture content. At the high and low moisture contents and at selected moisture levels in between, micrometer measurements were made of pods, kernels, and hulls to determine changes in size during drying. Pods and kernels were measured in length, width in the plane of suture, and width in the plane perpendicular to the suture. Hulls were measured for thickness. Decrease in pod, kernel, and hull measurements varied according to the peanut type. The larger the peanut and the thicker the hull, the higher the percentage of size decrease. In all three dimensions of measurement the percentage of decrease in kernel size was much greater than the percentage of decrease in pod size. Generally, there were no significant differences in the size change of the pods, but the kernels and the Virginia peanut hulls had significant size changes down to about 15% moisture content. Below 15%, size changes in pods, kernels, and hulls were measurable but not significant.

INTRODUCTION

When peanuts are dug at harvesttime, they contain 40% to 50% moisture. As moisture is removed from the peanuts during the drying process, pod and kernel dimensions change. Change in kernel size is of particular importance because it directly affects the grade, which in turn determines the monetary value of the peanuts.

Several studies have been made to determine how much peanut kernels shrink during curing and storage,² but the information is mostly limited to changes at relatively low moisture levels and is restricted to an analysis based on

official grade procedures that show weights of the various grade components in a sample, rather than the actual kernel size. The objective of this study was to determine the dimensional changes of peanut pods, kernels, and hulls as moisture is removed during the drying process.

METHODS AND MATERIALS

Green Virginia, runner,³ and Spanish peanuts were picked directly behind the digger. Each type was picked, mixed, and divided into several lots of approximately 4 cubic feet each. Each lot was mixed through a sample divider to obtain a rep-

¹Industrial engineer, National Peanut Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, Dawson, Ga. 31742.

²Blankenship, Paul D., and Hutchison, Reed S. 1971. Differences in the moisture content of mature and immature peanuts. U.S. Dep. Agric., Agric. Res. Serv. [Rep.] ARS 52-61, 14 pp. Person, N. K., Jr., Boase, S. M., Rigby, M. H., and Wood, Patricia K. 1973. Change in grade factors of

farmers' stock peanuts stored in the Southwest. Final Report, Cooperative Agreement No. 12-14-100-11,364(51), submitted to Dep. of Agric. Eng., Tex. Agric. Exp. Stn., 24 pp. Slay, Whit O., Hutchison, Reed S., and Heatwole, Roy E. 1974. Shrinkage of peanuts in storage in the Southeast. U.S. Dep. Agric., Agric. Res. Serv. [Rep.] ARS-S-29, 39 pp.

³'Florunner' was the only variety of runner peanut considered in this study.

representative sample, and the sample was then sized over the official Federal-State roller sizer to obtain three group sizes (table 1). The three groups were arbitrarily designated as small, medium, and large. An oven moisture determination was made on peanuts from each sample. Twenty sound pods from each of the three groups were selected, measured, numbered for identity preservation, and then placed in cotton mesh bags. Twenty additional pods from each group were selected, numbered, and each pod carefully cut with a razor blade along the suture line, leaving the halves of the pod as much intact as possible. The kernels were carefully removed and measured. To avoid error arising from natural hull curvature, a flat point on the hull was chosen for measurement, and a small dot was placed adjacent to this point for future measurement reference. The kernels were fitted back into the respective hull, and the hull closed and tied with a thin piece of sewing thread. The pods from each group that were used for kernel measurements were placed in separate cotton mesh bags. The remainder of the peanuts from each sample and the cotton mesh bags containing the peanuts for measurement were placed in a $\frac{1}{4}$ -inch-mesh bag. The mesh bags were placed just under the surface of the 4-cubic-foot bin of peanuts from which they were obtained. Each 4-cubic-foot lot was then placed on an artificial drying apparatus, and drying was done with 15 cubic feet per minute of air at 95°F per cubic foot of peanuts. Moisture determinations were made from peanuts in the $\frac{1}{4}$ -inch-mesh bags. At selected moisture levels the peanuts in the cotton bags were re-

TABLE 1.—*Group sizes of peanuts used for pod and kernel measurements*

Peanut type and group designation	Group size (inch)
Spanish:	
Small	Smaller than 25/64.
Medium	Between 29/64 and 25/64.
Large	29/64 or larger.
Runner:	
Small	Smaller than 25/64.
Medium	Between 29/64 and 25/64.
Large	29/64 or larger.
Virginia:	
Small	Smaller than 34/64.
Medium	Between 38/64 and 34/64.
Large	38/64 or larger.

moved and measured.

Pods and kernels were measured in three dimensions: length, width in the plane of suture, hereafter called the normal plane, and width in the plane perpendicular to the suture, hereafter called the perpendicular plane (fig. 1).

The results are presented by peanut type, and pod, kernel, and hull information appear in that order. Four replications of each type of peanut were made in fiscal years 1971 and 1972, and the results presented are the averages of the 2 years. Statistical treatment of the data consisted of an analysis of variance with a one-way classification and an analysis of least significant differences between the values at the indicated moisture levels.

Since it is common practice in the peanut industry to size peanuts over screens graduated in 64ths of an inch, a column with the data converted to 64ths of an inch has been added to the tables.

TEST RESULTS

Spanish Peanuts

Pods.—The decrease in pod length was nominal for all three groups of Spanish peanuts. The small pods decreased from an average length of 0.8222 inch at 35% moisture to 0.8144 inch at 6% moisture (table 2). The medium pods decreased 0.0100 inch from the initial length of 0.8714 inch, and the large pods decreased 0.0131 inch from the initial length of 0.8856 inch. The average decrease in pod length for the three groups combined was 1.5%.

In the normal plane, the groups of small, medium, and large pods decreased in width 0.0093, 0.0069, and 0.0111 inch, respectively, as the moisture content was reduced from 35% to 6%. There was less than 1% difference between the groups. The width of the pods in the normal plane was generally about one-half that of the length, but the percentage decrease as moisture content was lowered was greater than that of the length. The average decrease in width for the three groups combined was 2.3%.

In the perpendicular plane, the group of small pods decreased slightly more than the medium and large pods. Changes in this dimension were generally small in all groups of the Spanish peanuts. The average decrease in pod width was 1.2% for the three groups combined.

The small, medium, and large pods decreased a total of 6.0%, 4.5%, and 4.5%, respectively. The average decrease in size for the three groups of

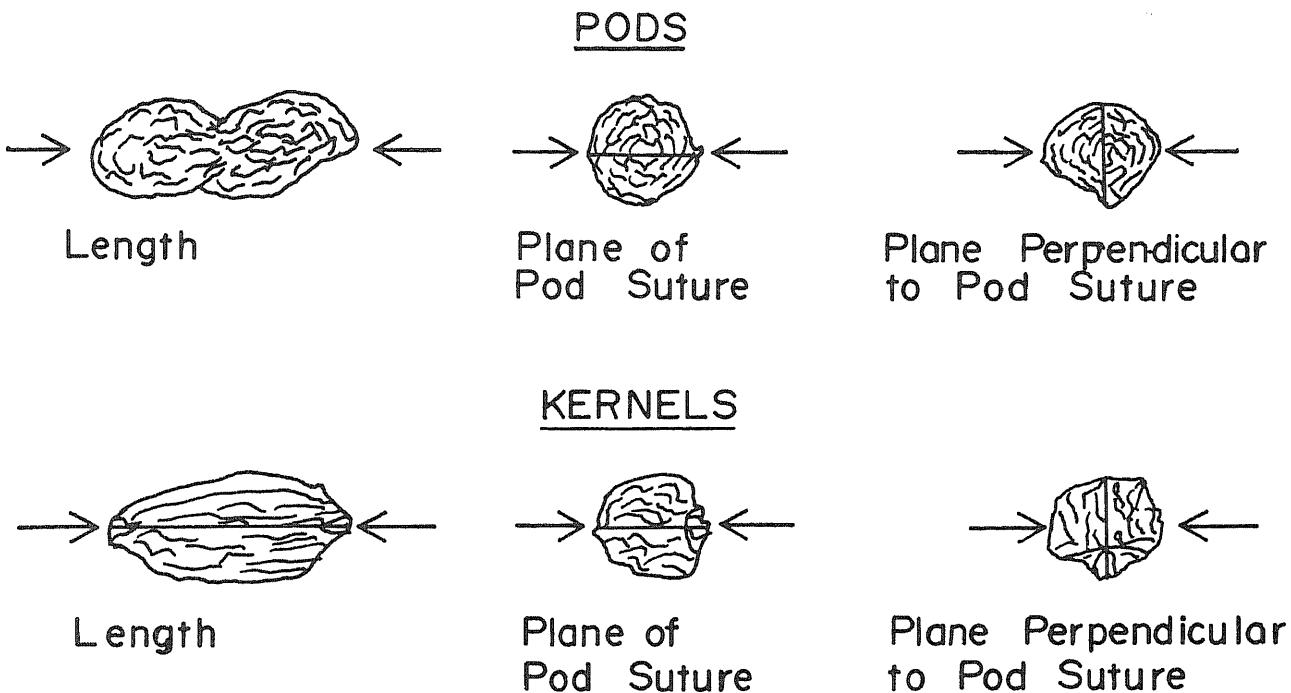


FIGURE 1.—Orientation of peanut pods and kernels for measurement.

Spanish peanut pods combined was 5.0%.

Kernels.—For Spanish peanuts, the percent decrease in kernel size was four to five times greater than the percent decrease in pod size. The small kernels decreased from 0.4471 inch at 35% moisture content to 0.3853 inch when the kernels reached 6% moisture content—a decrease of 0.0618 inch (table 3). The medium kernels decreased 0.0435 inch, and the large kernels decreased 0.0395 inch. The average change in length of kernels was 10.4% for the three groups combined.

In the normal plane, kernel width decreased more than the kernel length. The change in width in small and large kernels was the same, but exceeded the change in the medium kernels. The average decrease in kernel width was 12.3% for the three groups combined.

In the perpendicular plane, the greatest decrease in width occurred in the small kernels, followed, in descending order, by the decrease in the medium and large kernels. For the combined groups the average width of the kernels in the perpendicular plane was greater than the average width in the normal plane, but there was less change in width during the curing process. The average decrease in width in the perpendicular plane was 11.1%.

The small, medium, and large kernels de-

creased a total of 39.5%, 30.7%, and 30.3%, respectively. The average decrease in the combined dimensions of all groups of Spanish peanut kernels was 33.5%.

Hulls.—Hull moisture contents were not the same as for the kernels at any of the selected measuring times. Initially, hull moisture content was 42.1% compared to a kernel moisture content of 35%, and after a period of drying hull moisture content was 29.2% as kernel moisture content measurements were

TABLE 2.—*Three dimensions of Spanish peanut pods measured as moisture content decreased*

Moisture (%)	Length						Width in normal plane						Width in perpendicular plane					
	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch		
35	.8222	52.6	0.8714	55.8	0.8856	56.7	0.4021	25.7	0.4405	28.2	0.4799	30.7	0.4197	26.9	0.4413	28.2	0.4797	30.7
25	.8205	52.5	.8684	55.6	.8812	56.4	.4000	25.6	.4380	28.0	.4760	30.5	.4105	26.3	.4405	28.2	.4781	30.6
15	.8188	52.4	.8650	55.4	.8644	55.3	.3965	25.4	.4355	27.9	.4723	30.2	.4088	26.2	.4397	28.1	.4766	30.5
10	.8174	52.3	.8629	55.2	.8733	55.9	.3950	25.3	.4343	27.8	.4703	30.1	.4080	26.1	.4393	28.1	.4758	30.5
8	.8158	52.2	.8620	55.2	.8735	55.9	.3939	25.2	.4339	27.8	.4695	30.0	.4073	26.1	.4391	28.1	.4752	30.4
6	.8144	52.1	.8615	55.1	.8725	55.8	.3928	25.1	.4336	27.8	.4688	30.0	.4065	26.0	.4390	28.1	.4750	30.4

TABLE 3.—*Three dimensions of Spanish peanut kernels measured as moisture content decreased*

Moisture (%)	Length						Width in normal plane						Width in perpendicular plane					
	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch		
35	.0.4471	28.6	0.4625	29.6	0.4715	30.2	.0.2985	19.1	.0.3195	20.4	.0.3338	21.4	.0.3275	21.0	.0.3572	22.9	.0.3668	23.5
25	.1.4239	27.1	.4465	28.6	.4572	29.3	.1.2838	18.2	.3085	19.7	.3230	20.7	.1.3103	19.9	.3430	22.0	.3570	22.8
15	.1.4008	25.7	.4304	27.5	.4429	28.3	.2691	17.2	.2975	19.0	.3122	20.0	.1.2932	18.8	.3288	21.0	.3471	22.2
10	.3904	25.0	.4238	27.1	.4358	27.9	.2626	16.8	.2931	18.8	.3079	19.7	.2858	18.3	.3240	20.7	.3432	22.0
8	.3881	24.8	.4215	27.0	.4339	27.8	.2605	16.7	.2927	18.7	.3062	19.6	.2848	18.2	.3233	20.7	.3428	21.9
6	.3853	24.7	.4190	26.8	.4320	27.6	.2583	16.5	.2923	18.7	.3045	19.5	.2838	18.2	.3228	20.7	.3425	21.9

¹Significant at 5% level.TABLE 4.—*Three dimensions of runner peanut pods measured as moisture content decreased*

Moisture (%)	Length						Width in normal plane						Width in perpendicular plane					
	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch		
38.5	0.8029	51.4	0.9774	62.5	1.1453	73.3	0.3991	25.5	0.4663	29.8	0.5363	34.3	0.4119	26.4	0.4405	28.2	0.5146	32.9
25	.7927	50.7	.9763	62.5	1.1426	73.1	.3921	25.1	.4648	29.7	.5336	34.2	.4053	25.9	.4388	28.1	.5139	32.9
15	.7838	50.5	.9714	62.2	1.1306	72.4	.3865	24.7	.4598	29.4	.5284	33.8	.4014	25.7	.4368	28.0	.5100	32.6
10	.7819	50.4	.9673	61.9	1.1317	72.4	.3853	24.7	.4567	29.2	.5248	33.6	.4011	25.7	.4360	27.9	.5084	32.5
8	.7868	50.4	.9654	61.8	1.1300	72.3	.3841	24.6	.4551	29.1	.5233	33.5	.4005	25.6	.4352	27.9	.5074	32.5
6	.7860	50.3	.9638	61.7	1.1278	72.2	.3833	24.5	.4538	29.0	.5208	33.3	.4000	25.6	.4345	27.8	.5065	32.4

TABLE 4.—*Dimensions of Spanish peanut hulls at various moisture contents*

Moisture (%)	Thickness (inch)		
	Small	Medium	Large
42	0.0210	0.0250	0.0320
29	.0200	.0240	.0290
17	.0200	.0240	.0300
13	.0190	.0230	.0280
11	.0190	.0230	.0280
10	.0190	.0230	.0280

Runner Peanuts

Pods.—The decrease in length of the runner peanut pods varied according to group size. From an average length of 0.8029 inch at 38.5% moisture content, the small pods decreased 0.0169 inch when reduced to 6% moisture (table 5). The medium pods decreased 0.0136 inch from their initial length of 0.9774 inch, and the large pods decreased 0.0175 inch from their initial length of 1.1453 inches. The average decrease in length for the pods of the three groups combined was 3.1%.

There was a greater percentage of change in the normal plane than in the length or the perpendicular plane. In the normal plane, the small pods changed most, followed, in descending order, by the medium and large pods. The width of the pods in the normal plane was less than one-half the length, but the changes in width were approximately 2% greater than the changes in length. The average decrease in width was 5.3% for the pods of the three groups combined.

In the perpendicular plane the small pods had the highest percentage of decrease in width, followed, in descending order, by the medium and large groups. The average decrease in pod width for the three groups combined was 4.6%.

The small pods decreased 17.9% in all three dimensions, as compared to decreases of 11.2% and 9.9%, respectively, for medium and large pods. The combined dimensions for all groups of runner peanut pods decreased by an average of 13.0%.

Kernels.—The kernels of the runner peanuts decreased in size approximately twice as much as the pods. From an initial length of 0.4958 inch at 38.5% moisture, the small kernels decreased 0.0633 inch when reduced to 6% moisture (table 6). The medium kernels decreased 0.0756 inch; the large kernels decreased 0.0737 inch. The average decrease in kernel length was 10.8% for the three groups combined.

The kernels decreased in the normal plane much more than in length. The greatest decrease was in the small kernels. The large and medium kernels decreased by almost the same amount. The average decrease in kernel width was 15.2% for the three groups combined.

In the perpendicular plane, the greatest decrease in width was 13.9% in the small kernels, followed by decreases of 13.7% and 13.4%, respectively, in the medium and large kernels. The average decrease in width in the perpendicular plane was 13.7% for the three groups combined.

In total decrease, the small kernels decreased 46.3%; the medium and large kernels decreased 40.7% and 37.7%, respectively. The average overall decrease in kernel size for all groups was 41.5%.

Hulls.—Runner peanut hulls dried at a rate different from that of the kernels. Hull thickness varied according to the pod size of the group (table 7), but after the moisture content of the hulls reached 15%, the decrease was almost negligible. Large pods had an average hull thickness of 0.254 inch, as compared to 0.0219 and 0.0194 inch, respectively, for medium and small pods. The percent decrease in thickness varied according to the pod size of the group, with an 18.6% decrease in the small pods, and a 12.8% and 11.0% decrease in the medium and large pods, respectively. The average decrease in hull thickness for the combined groups was 14.1%.

Virginia Peanuts

Pods.—The decrease in pod length of the Virginia peanuts did not differ extremely from group to group. From an average length of 1.1889 inches at 41% moisture, the small pods decreased 0.0374 inch when reduced to 6% moisture content (table 8). The medium pods decreased 0.0506 inch from an initial length of 1.4458 inches, and the large pods decreased

TABLE 7.—*Dimensions of runner peanut hulls at various moisture contents*

Moisture (%)	Thickness (inch)		
	Small	Medium	Large
38	0.0194	0.0219	0.0254
25	.0179	.0203	.0244
15	.0165	.0195	.0232
11	.0161	.0192	.0224
11	.0159	.0191	.0224
10	.0158	.0191	.0226

TABLE 6.—*Three dimensions of runner peanut kernels measured as moisture content decreased*

Moisture (%)	Length			Width in normal plane						Width in perpendicular plane					
	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	
38.5	.04958	31.7	.05531	35.4	.06530	41.8	.02992	19.1	.03250	.03691	23.6	.03331	21.3	.03613	23.1
25	.4539	29.0	.5073	32.5	.6095	39.0	.2703	17.3	.2931	.3392	21.7	.2993	19.2	.3244	20.8
15	.4321	27.7	.4865	31.1	.5834	37.3	.2556	16.4	.2777	.3213	20.6	.2823	18.1	.3064	19.6
10	.4353	27.9	.4826	30.9	.5843	37.4	.2589	16.6	.2796	.3224	20.6	.2881	18.4	.3127	20.0
8	.4339	27.8	.4796	30.7	.5813	37.2	.2584	16.5	.2782	.3202	20.5	.2874	18.4	.3120	20.0
6	.4325	27.7	.4775	30.6	.5793	37.1	.2578	16.5	.2773	.3193	20.4	.2868	18.4	.3115	19.9

¹Significant at the 5% level.TABLE 8.—*Three dimensions of Virginia peanut pods measured as moisture content decreased*

Moisture (%)	Length			Width in normal plane						Width in perpendicular plane					
	Small Inches	Medium Inches	Large Inches	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	
41	1.1889	76.1	1.4458	92.5	1.5529	99.4	0.5235	33.5	0.5913	37.8	0.6128	39.2	0.5118	32.8	0.5708
25	1.1767	75.3	1.421	90.9	1.5329	98.1	.5122	32.8	.5768	36.9	.5633	36.1	.5032	32.3	.5633
15	1.1671	74.7	1.4158	90.6	1.5198	97.3	.5052	32.3	.5683	36.4	.5918	37.9	.5012	32.1	.5583
10	1.1629	74.4	1.4075	90.1	1.5095	96.6	.5010	32.1	.5639	36.1	.5828	37.3	.4958	31.7	.5552
8	1.1600	74.2	1.4038	89.8	1.5067	96.4	.4973	31.8	.5614	35.9	.5797	37.1	.4936	31.6	.5438
6	1.1515	73.7	1.3952	89.3	1.4960	95.7	.4903	31.4	.5498	35.2	.5733	36.7	.4882	31.2	.5397

TABLE 9.—*Three dimensions of Virginia peanut kernels measured as moisture content decreased*

Moisture (%)	Length			Width in normal plane						Width in perpendicular plane					
	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	64ths Inch	Small Inch	Medium Inch	Large Inch	64ths Inch	
41	.07577	48.5	.07976	51.0	.08575	54.9	.03585	22.9	.03620	.23.2	.03731	23.9	.04261	27.3	.04136
25	.7145	45.7	.7514	48.1	.8206	52.5	.3351	21.4	.3347	21.4	.3677	23.5	.3742	23.9	.3848
15	.6881	44.0	.7217	46.2	.7971	51.0	.3202	20.5	.3177	20.3	.3493	22.4	.3554	22.7	.3667
10	.6727	43.1	.7082	45.3	.7850	50.2	.3077	19.7	.3084	19.7	.3384	21.7	.3486	22.3	.3606
8	.6680	42.8	.7024	45.0	.7803	49.9	.3042	19.5	.3037	19.4	.3312	21.2	.3445	22.0	.3580
6	.6575	42.1	.6932	44.4	.7724	49.4	.2958	18.9	.2966	19.0	.3259	20.9	.3386	21.7	.3517

¹Significant at the 5% level.

0.0569 inch from an initial length of 1.5529 inches. The average percent decrease in pod length was 3.5% for the three groups combined.

In the normal plane, decrease in width was approximately the same for all groups of pods. Small pods decreased 6.3% and medium and large pods decreased 7.0% and 6.4%, respectively. The width of the pods in the normal plane was slightly less than one-half the length, but the percent decrease was approximately twice that of the length. The average decrease in width in the normal plane was 6.6% for the three groups combined.

In the perpendicular plane, the large pods had the greatest decrease in width, followed, in order, by the medium and small pods. Combining the three groups, the average decrease in width in the perpendicular plane was 5.9%.

The total decrease in all dimensions was 17.8% for the large pods and 15.9% and 14.1%, respectively, for the medium and small pods. The combined dimensions for all groups of Virginia peanut pods decreased by an average of 15.9%.

Kernels.—Kernels of the Virginia peanut decreased in size much more than did the pods. From an initial length of 0.7577 inch at 41% moisture, the small kernels decreased 0.1002 inch when reduced to 6% moisture (table 9). The medium kernels decreased 0.1044 inch, and the large kernels decreased 0.0851 inch. The kernels decreased in length about three times more than did the pods. The combined groups averaged 12.1% decrease in kernel length.

There was a much greater decrease in the width of kernels in the normal plane than there was decrease in length. In the normal plane, the greatest decrease in width was observed in the medium kernels, though the small kernels decreased only slightly less. Large kernels decreased approximately two-thirds as much as small and medium kernels. The average decrease in width was 16.1% for the groups combined.

The greatest decrease in width in the perpendicular plane occurred in the small kernels. Medium kernels were next in the amount of decrease. Combined, the groups had an average decrease in width in this plane of 14.8%.

The small kernel group decreased 51.2% in all three dimensions combined; medium and large kernels decreased by 46.2% and 34.2%, respectively. The average decrease in the combined

dimensions of all groups was 43.2%.

Hulls.—Virginia peanut hulls did not dry at the same rate as the kernels. The initial measurement of hull thickness was made at a hull moisture of 53.6%. Subsequent measurements of hull thickness were made at the predetermined levels of moisture picked to measure kernels, regardless of hull moisture at the time. Hull thickness varied according to group size (table 10), the large pod group having the thickest hull of 0.0437 inch. The medium and small pod groups had hull thicknesses of 0.0361 and 0.0350 inch, respectively. Losses in hull thickness were 0.0127, 0.0113, and 0.0144 inch, respectively, for the small, medium, and large pods. The hulls of the large pods had slightly larger losses in thickness initially and overall. Generally, after the hulls reached approximately 11% moisture, no further measurable decreases in hull thickness occurred. The average decrease in hull thickness was 33.5% for the three groups combined.

TABLE 10.—*Dimensions of Virginia peanut hulls at various moisture contents*

Moisture (%)	Thickness (inch)		
	Small	Medium	Large
53.6	¹ 0.0350	¹ 0.0361	¹ 0.0437
25.0	¹ .0298	¹ .0308	¹ .0364
16.7	.0281	¹ .0290	.0339
10.7	¹ .0224	¹ .0259	.0300
8	.0224	.0253	.0296
8.3	.0223	.0248	.0293

¹Significant at 5% level.

DISCUSSION

The extent to which peanuts decrease in size during the drying process depends primarily upon the type of peanut, the amount of moisture removed, and the peanut's maturity. The greatest decrease in size occurs when "green" or high-moisture peanuts are reduced to the intermediate moisture level at which artificial drying usually begins. The size decrease becomes progressively smaller as moisture is removed. By the time peanuts are dried to moisture levels considered safe for storage, the size decrease in pods and hulls has become almost negligible. The kernels follow the same pattern, but decrease in size is measurable as the kernels are reduced to much lower moisture levels.

Generally, the largest dimension of peanut

pods and kernels is length, followed in descending order by the dimensions of the perpendicular and normal plane. However, the greatest percentage of size decrease usually occurs in the normal plane, followed by decreases in the perpendicular plane and length, respectively.

Reduction in hull size is governed by the same conditions that affect pod and kernel size. The peanuts in the small groups were presumably less mature than those in the medium and large groups, and in general, a higher percentage of decrease in hull thickness was observed in the small groups.

Although measurable size changes occurred in the pods of all three peanut types as moisture was removed, the changes were not significant. The percentage change in pod size coincided with the pod size characteristic associated with the three peanut types, i.e., the Virginia peanuts had the largest pods and the most change, followed by the runner and Spanish pods, respectively. In the three groups of pods within each peanut type, the smaller pods generally changed more than the medium and large pods. The one exception was the group of large pods of the Virginia peanuts which changed slightly more than the group of small pods. Overall, the average de-

crease in pod size was 5%, 7%, and 16%, respectively, for the Spanish, runner, and Virginia peanuts.

There were significant size changes in the kernels of all three peanut types. With some of the peanut kernel groups, the changes were significant down to the 15% moisture level. The group of small kernels in each peanut type changed most in size with the exception of the medium group of kernels in the runner peanuts. This group changed slightly more than the group of small runner kernels. The percentage change in kernel size followed the size characteristic associated with the peanut type, i.e., the Virginia peanuts had the largest kernels and the most change, followed by the runner and Spanish kernels, respectively. Overall, the average decrease in kernel size was 31%, 40%, and 43%, respectively, for the Spanish, runner, and Virginia kernels.

There was no significant change in hull thickness except with the Virginia peanut hulls at high moisture levels. Overall, the average decrease in hull thickness was 10%, 14%, and 34%, respectively, for the Spanish, runner, and Virginia peanut hulls.

ACKNOWLEDGMENTS

This work was conducted under the general supervision of Reed S. Hutchison, research leader, National Peanut Research Laboratory, Agricultural Research Service, Dawson, Ga. The author expresses appreciation to William G. Ferguson, engineering technician, and to Larry S. Creel, commodity grader, both of the National Peanut Research Laboratory, for their assistance in conducting the test and collecting the data.

*1976-G.P.O.-1750S-671-583-23